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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development					R-1 ITEM NOMENCLATURE Communication and Simulation Technology PE 0603761E, R-1 #49					
COST *(In Millions)*	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost To Complete	Total Cost
Total Program Element (PE) Cost	70.165	52.258	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A
Advanced Simulation CST-01	29.050	26.397	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A
Global Grid Communications CST-02	38.519	25.861	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A
Defense Simulation Internet (DSI) CST-03	2.596	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A

(U) Mission Description:

(U) This program element is budgeted in the Advanced Technology Development Budget Activity because it's purpose is to demonstrate and evaluate advanced simulation technologies and networking systems that will seamlessly integrate command and control functions needed for future global defense operations.

(U) The Advanced Simulation project is developing advanced simulation technologies that provide seamless synthetic battlespace that will enable high fidelity simulation across a full range of DoD functions. As technologies mature, they are integrated, tested and demonstrated in exercise/demonstrations of varying size and complexity. Within this project, the Synthetic Theater of War (STOW) Advanced Concept Technology Demonstration (ACTD) program is developing advanced simulation technologies to provide a seamless synthetic battlespace to support joint training and mission rehearsal activities. These technologies will be transitional to service and joint simulation developers at the end of FY 1999.

(U) The Global Grid Communications project is developing and demonstrating advanced networking technologies needed for global defense operations in the 21st century. Network services will be developed in order to support geographically dispersed staff for crisis management and to support warfighters in rapid deployment, highly mobile scenarios. The program requires the design, adaptation and development of new internetwork protocols. The three main efforts in this project are: (1) the Joint Task Force Advanced Technology Demonstration (JTF-ATD) of a rapid Commander Joint Task Force (CJTF) crisis response capability for a range of situations from Major Theater War (MTW) to Operations Other Than War (OOTW) capable of being established and operational in days; (2) the Warfighter's Internet program which develops and demonstrates a

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mobile wireless backbone communications network consisting of multiple airborne nodes which in turn connect to users and networks on the ground, on the ocean, and in the air, and (3) the Broadband Information Technology (BIT) program which seeks to develop all-optical multiple wavelength transmission and networking technologies. These technologies will transition to the Services at the end of FY 1999.

(U) The goal of the Defense Simulation Internet (DSI) program is to research, develop and test at scale (worldwide), a network infrastructure capable of enabling distributed, real-time, multi-media (video, voice, shared data and work spaces) simulation that will seamlessly integrate all simulation, modeling, command and control functions from early design to battle rehearsal enroute to the conflict. The DSI transitioned to the Defense Information Systems Agency (DISA) Defense Information System Network (DISN) on a fully reimbursable basis at the end of FY 1998.

(U) **Program Change Summary:** (*In Millions*)	**FY1998**	**FY 1999**	**FY 2000**	**FY 2001**
Previous President's Budget	74.212	56.114	29.750	31.049
Current Budget	70.165	52.258	0.000	0.000

(U) Change Summary Explanation:

FY 1998	Decrease reflects reduction of the Warfighter's Internet and SBIR reprogramming adjustments.
FY 1999	Decrease reflects transition of Defense Information Infrastructure Common Operating Environment (DII COE) to AITS JPO.
FY 2000/01	Decrease reflects transition of the STOW ACTD, JTF ATD, Broadband Information Technology and Warfighter's Internet programs to the Services.

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COST *(In Millions)*	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Advanced Simulation CST-01	29.050	26.397	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A

(U) Mission Description:

(U) The strategic environment in which the United States operates will require Joint Forces to operate across the full spectrum of conflict. At the same time, resources will continue to shrink, requiring the Department to search for the most cost effective means to perform the full spectrum of defense functions. To support the National Military Strategy, the Advanced Distributed Simulation (ADS) program is developing advanced simulation technologies that provide a seamless synthetic battlespace that will enable high fidelity simulation for Joint/Service readiness training and mission rehearsal. Within the ADS Programs the Synthetic Theater of War (STOW) Advanced Concept Technology Demonstration (ACTD) program is developing advanced simulation technologies that provide a seamless synthetic battlespace to support joint training and mission rehearsal activities. The STOW ACTD technology development includes Synthetic Environment, Synthetic Forces, System Design and Integration and Advanced Network components. The Synthetic Environment component concentrates on the creation of large scale digital environments including, representation of dynamic terrain and targets, weather and environmental phenomena, as well as seasonal and diurnal variations. The Synthetic Forces component creates a scalable, computer-generated joint military force that is both representative and behaviorally credible. This platform-based simulation includes models of command forces as well as intelligence sensors and their related platforms. The high fidelity of the computer-generated forces provides the capability to resolve battle outcomes at the weapon system level of detail. The System Design and Integration component develops the overall DoD High Level Architecture (HLA)/ Run Time Infrastructure (RTI) compliant system design, interfaces to C4I systems, distributed exercise management, data collection and after action review applications. These technologies will transition to Service and joint simulation developers at the end of FY 1999.

(U) The Advanced Simulation Technology Thrust (ASTT) program builds on the STOW Program and develops the advanced simulation technologies required to support the next generation of DoD simulation systems, such as the Joint Simulation system (JSIMS). The goal of the ASTT program is to solve the core technology problems required to significantly increase the flexibility of simulations while simultaneously reducing the requisite resources (cost, personnel and time). DARPA's ASTT technology development efforts complete in FY 1999.

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(U) Program Accomplishments and Plans:

(U) FY 1998 Accomplishments:

- Based on lessons learned from Unified Endeavor 98-1 and USACOM revised operational requirements, improved the STOW prototype and provided operational demonstrations of an increased capability to the joint warfighter in support of USACOM and the services. This included enhancing the warfighter's capabilities to employ high fidelity, platform level simulations for a variety of missions, by improving technology, tools and applications. Integrated new/improved synthetic environments, synthetic forces, and networking technologies as well as products developed in conjunction with the United Kingdom's Synthetic Environment Program. Continued transition of STOW technologies to JSIMS and other DoD users. ($ 12.619 Million)

- Continued development of Advanced Simulation Technologies in the ASTT program to support JSIMS, WARSIM and other service simulations. Technology efforts included: Adaptive multi-skilled Synthetic Forces; scalability to greater than 20,000 objects; distributed multi-cast data collection on large amounts of data; rapid generation of computer generated forces and alternative methods of Synthetic Force generation; single synthetic environments database abstraction to accommodate multiple simulation requirements; initial multi-resolution modeling techniques. ($ 11.521 Million)

- Continued to develop and demonstrate Course of Action Analysis (COAA) technology based on advanced simulation technology and related modeling techniques. Extended FY 1997 effort to provide a tightly coupled COA development/COA analysis environment that shortens the overall planning cycle by 50%. Evaluated: extension of COAA technology to other Services; next generation COAA analysis techniques (such as advanced adversarial reasoning); and the techniques necessary to tightly integrate the mission planning/mission rehearsal/mission execution monitoring end-to-end process as it applies to land combat. ($ 4.910 Million)

(U) FY 1999 Plans:

- Continue to refine and transition prototype technologies in support of USACOM and the Services. Demonstrations will focus on the representation of a seamless land/sea/air warfighting synthetic environment with an ever-increasing degree of realism, and C2 interfaces, to support Service and joint operational training and analyses while retaining the arbitration of battle outcomes at the platform level of

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resolution. Transition technology, tools and applications in support of the next generation of DoD simulations. The STOW ACTD will conclude by end of FY 1999. ($ 14.128 Million)

- Continue to develop high risk Advanced Simulation Technologies required by, and in coordination with, JSIMS and other Service simulations (e.g. WARSIM) to meet their respective Full Operational Capability (FOC) requirements. Technology efforts will include: the rapid composition effort has developed the algorithms to automatically translate exercise requirements into simulation requirements and to automatically compose the resulting simulation. The synthetic force component has created a scalable framework for modeling the C2 hierarchical and collaborative decision-making process through the Joint Task Force level required to automatically generate and evaluate multiple courses of action. The synthetic environment component has developed consistency algorithms to support the rapid editing of environmental data (pre-exercise & run time) while maintaining temporal and spatial consistency within and across all environmental domains (air, land, & ocean). The scalable executing system component has redefined the distributed simulation paradigm by centralizing the simulation objects and distributing the interfaces and by applying advanced latency reduction techniques and dynamic data distribution algorithms to achieve scalable architectures necessary to support large scale, distributed simulations. Continue to transition all technologies to JSIMS, et al. ($ 12.269 Million)

(U) FY 2000 Plans:

- Not Applicable.

(U) FY 2001 Plans:

- Not Applicable.

(U) Other Program Funding Summary Cost:

- Not Applicable.

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(U) Schedule Profile:

Plan	Milestones
Jun 99	Support USACOM JE99-01.
Sep 99	Complete the development, integration and documentation of the STOW prototype. Complete final transition of STOW Technology to JSIMS/JWARS and the military service.
Sep 99	Complete the development of ASTT technologies and proof of principles.
Sep 99	Transition ASTT simulation technologies to the JSIMS and the Service simulation developments.
Sep 99	Program completion and close out.

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COST *(In Millions)*	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Global Grid Communications CST-02	38.519	25.861	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A

(U) Mission Description:

(U) This project develops and demonstrates advanced networking technologies needed for global defense operations in the 21st century. Network services will be developed in order to support geographically dispersed staff for crisis management and to support warfighters in rapid deployment, highly mobile scenarios. The program will demonstrate that information technologies can be integrated with both advanced optical, high performance networks and mobile, wireless tactical. This will provide multimedia information flows, efficient use of bandwidth, and minimal logistical requirements for warfighting, disaster relief, and emergency medical support. The program requires the design, adaptation and development of new internetwork protocols. These technologies will be transitioned to the Services at the end of FY 1999.

(U) The goal of the Joint Task Force Advanced Technology Demonstration (JTF ATD) is the development of rapid crisis response capabilities for the Commander Joint Task Force (CJTF) in support of a wide range of situations from Major Theater War (MTW) to Operations Other Than War (OOTW). The JTF ATD will create a supportable, global grid-based C4I technology base that will deliver an exponential increase in decision support capability to the theater CINC and JTF commander during crisis planning, rehearsal, and execution. The JTF ATD will provide an initial set of composable services that enables system developers with the ability to provide common servers and application suites that supports the Warfighters needs.

(U) The goal of a Warfighter's Internet is to expand open architecture and internetworking technologies into the mobile wireless domain to: provide a robust, automatically reconfigurable, internetworking capability; and, to support warfighters in rapid deployment and highly mobile scenarios. This will be accomplished as a joint effort with the Airborne Communications Node program and will enable a backbone communications network consisting of multiple airborne nodes which in turn connect to users and networks on the ground, on the ocean, and in the air. Provision for multimedia information flows, efficient use of bandwidth, and minimal logistical requirements are key objectives that require the design, adaptation and development of new network protocols for mobile, wireless battlefield networks. Technology development and demonstration will focus on networking technologies to integrate existing and developmental communication systems and networks using airborne nodes such as Global Hawk (Airborne Communications Node). A scalable internet will be demonstrated in conjunction with joint service exercises and advanced warfighting experiments.

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(U) The Broadband Information Technology (BIT) program seeks to develop all-optical multiple wavelength transmission and networking technologies. Specifically, this program has four goals: (1) a billion bit per second bandwidth on demand, independent of the analog and digital nature of the applications, (2) rapid, nearly transparent reconfiguration of network routing, (3) multiplexing of continuous transmission rates (bit rates from thousands of bit per second to billion of bits per second), and (4) transmission of analog and digital signals in a single fiber.

(U) Program Accomplishments and Plans:

(U) FY 1998 Accomplishments:

- The Broadband Information Technology project demonstrated multi-wavelength network management and control in local area testbeds. ($ 6.195 Million)

- Broadband Information Technology projects demonstrated 40 billion bits per second cross-connect switching and 32 channel transceiver chip. ($ 8.700 Million)

- Continued analysis and report on economics of multi-wavelength network architecture and technology for local area optical networks. ($ 1.300 Million)

- Developed several Common Object Request Broker Architecture (CORBA) compliant composable services and developed a composer that provides system developers automated code generated servers that support the Warfighter's crisis planning applications. Also supported the extension of the infrastructure, architecture, servers and applications across computing platform classes and to emerging and related programs within the DARPA ISO development environment with the composable services. Demonstrated the composable services at the DARPA Information Superiority Technology Integration (ISTI-98) event. ($ 16.599 Million)

- Completed design and development of first phase of mobile, wireless network software and protocols, self-organizing cross links, network and mobility management, security, application interfaces, signaling protocols and RF subsystem integration and engineering based on the DARPA-led, joint Service study that defined technical requirements and network systems architecture for a Warfighter's Internet/joint tactical internetwork. Integrated technology with the Airborne Communications Node payload requirements/design. Continued Advanced

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Digital Receiver and radio frequency microelectromechanical systems (RF MEMS) Tunable Filters technology efforts. Initiated time varying magnetic flux antenna investigation. ($ 5.725 Million)

(U) FY 1999 Plans:

- Broadband Information Technology project will demonstrate full operations, multi-wavelength, experimental, system network including interoperability among testbeds distributed across several geographic domains. ($ 5.564 Million)

- Deliver JTF ATD developed composable services and provide infrastructure support to the Technology Integration Center (TIC) in this last year of the JTF ATD. Move the JTF ATD's integration and experimentation environments to the TIC. Extend and finalize the composable services system developers tools and transition the composable services and tools to the TIC repository. Execute Technology Integration Experiments (TIEs) with several DARPA ISO projects and at least the JL and ACOA ACTDs. In support of these activities hold several training sessions (boot camps) for prospective adopters of the composable services. ($ 5.518 Million)

- Warfighter's Internet project will integrate technology with the Airborne Communications Node developments. In coordination with Airborne Communications Node, initiate test & demonstration of airborne cross links, wireless backbone using manned aircraft; continue to develop network protocols and integrate into commercial products; integrate legacy and emerging radios in mobile, wireless internet. Demonstrate increased warfighter capabilities as part of combined ACN demonstration in late FY 1999. Complete Advanced Digital Receiver technology development and integration. Continue RF MEMS Tunable Filter, programmable INFOSEC, advanced digital transmitter/external power amplifier and antenna technology developments. ($ 14.779 Million)

(U) FY 2000 Plans:

- Not Applicable.

(U) FY 2001 Plans:

- Not Applicable.

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(U) Other Program Funding Summary Cost:

- Not Applicable.

(U) Schedule Profile:

Plan	Milestones
3Q FY99	Deliver JTF ATD composable services and system developers tools.
3Q FY99	Demonstrate 20 gigabit per second, multi-channel, multi-media, and large-area network.
4Q FY99	Field demonstration of mobile wireless network technologies coordinated with BADD, Extended Littoral Battlespace (ELB) and Small Unit Operations experiments.
4Q FY99	Complete Advanced Digital Receiver and RF MEMS Tunable Filters upgrades.
4Q FY99	Deliver JTF ATD composable services and developers tools to the TIC repository.